

1 CASSETTE SYSTEMS FOR FEEDING, COUNTING AND
2 DISPENSING DISCRETE OBJECTS

3
4 BACKGROUND OF THE INVENTION

5
6 1. Field of the Invention

7 This invention relates broadly to feeding, counting and
8 dispensing apparatus. More particularly, this invention relates
9 to feeding and counting apparatus which use vibration to control
10 the flow of discrete items, such as tablets, capsules or caplets
11 being fed and counted.

12
13 2. State of the Art

14 In retail, hospital, and mail order medication dispensing, a
15 large number of different prescriptions of single dose
16 medications, such as tablets, must be filled. (Hereinafter, for
17 purposes of brevity, reference to "tablets" should be understood
18 for purposes herein as being generic to tablets, capsules, caplets
19 and any other solid dose medication). For prescriptions requiring
20 small quantities of a medication, the prescription is often filled
21 by hand; that is, a bulk container containing the prescription
22 medication is removed from a shelf and opened. A quantity of the
23 medication is poured into a tray and the medication tablets are
24 counted by a pharmacist and then dispensed into a patient
25 prescription bottle. The remainder of the medication in the tray

1 is returned to the bulk container, the container is closed, and
2 then replaced on the shelf.

3
4 Larger quantity prescriptions are often filled with the aid
5 of a counting apparatus intended to more rapidly count different
6 quantities of different tablets successively. For example, a
7 prescription for ninety tablets of 10 mg Claritin® may need to be
8 filled after a prescription for sixty tablets of 400 mg Motrin®.
9 Generally, there are two types of counting apparatus available for
10 dispensing prescription medication from bulk containers of such
11 medications: a preset counter and a pour-through counter.

12
13 With a preset counter, the pharmacist obtains a bulk
14 container of a prescription medication from a shelf and then pours
15 from the container a quantity of tablets into a hopper of the
16 counting apparatus. The pharmacist then sets the counting
17 apparatus to the number of tablets to be counted, e.g., ninety.
18 Assuming at least the required number of tablets for the
19 prescription has been poured into the hopper, the pharmacist waits
20 while the counting apparatus counts the required number of tablets
21 and dispenses the tablets into a patient prescription bottle. The
22 excess tablets are discharged back into the bulk container, which
23 is then replaced on the shelf. It has been found that the time
24 taken to discharge the excess tablets can be equal to or greater

1 than the time required to count the prescription. For that
2 reason, the pour-through counter has proved more popular.
3

4 A pour-through counter does not include a hopper that
5 temporarily stores the medication. Rather, the pharmacist pours
6 tablets from a bulk container directly into a funnel which drops
7 the tablets past a counter and dispenses them into a patient
8 bottle. The pharmacist pours until the digital readout of the
9 counter apparatus displays the required number of tablets, and
10 then stops. As such, there is usually no excess. However, should
11 an extra tablet or so fall into the funnel, the readout clearly
12 indicates the extra number, and the excess can easily be removed
13 by the pharmacist and returned to the storage container.
14

15 Both the preset and pour-through counter systems have a
16 common drawback. Each prescription medication must be obtained
17 from a bulk storage container located in stock, which must be
18 opened prior to use and closed after use. In order to minimize
19 the time taken to dispense a prescription, counter manufacturers
20 have provided "cassette counters" for retail, hospital, and mail
21 order pharmacies. Each cassette is designed for a specific size
22 and shape capsule, tablet, or caplet. The cassettes are pre-
23 filled by the pharmacist with bulk quantities of the appropriate
24 prescription drugs, and are used to store bulk quantities rather
25 than using the container supplied by the manufacturer. The

1 prescription medication is then dispensed directly from the
2 cassette. The use of cassettes eliminates the time needed to open
3 the manufacturer's original container, the time needed to return
4 excess tablets to the container, and the time needed to close the
5 container. Unfortunately, cassette counters are slow and prone to
6 breaking tablets. Furthermore, when cassettes jam, as they often
7 do, they are difficult to unclog. Often tablets spill
8 uncontrollably from the cassette during attempts to unclog a jam.
9 Further, since the cassettes used in existing cassette systems are
10 specific to the tablet being dispensed, each time a pharmacist
11 wants to count a new drug, a new cassette designed for that
12 specific medication must be obtained. In addition, some
13 prescriptions are filled infrequently and it is not economically
14 feasible or practical to have a dedicated cassette for every solid
15 dose medication in the pharmacy.

16 17 SUMMARY OF THE INVENTION 18

19 It is therefore an object of the invention to provide a
20 system for counting and dispensing discrete objects such as
21 tablets, capsules and the like which permits storing discrete
22 objects in a manner in which the objects may be quickly dispensed.

1 It is another object of the invention to provide a counting
2 and dispensing system which uses cassettes which are not
3 customized to a particular tablet or capsule.
4

5 It is a further object of the invention to provide a counting
6 and dispensing system which uses cassettes which are relatively
7 inexpensive to manufacture.
8

9 It is an additional object of the invention to provide a
10 counting and dispensing system which is not subject to jamming by
11 discrete objects being counted.
12

13 Another object of the invention is to provide a counting and
14 dispensing system which provides rapid counting of the discrete
15 objects.
16

17 A further object of the invention is to provide a counting
18 and dispensing system which can also be used without a cassette.
19

20 An additional object of the invention to provide a counting
21 and dispensing system which has the benefits of two different
22 modes of operation, as a pour through counter, as well as a preset
23 counter.
24

1 Yet a further object of the invention is to provide a
2 counting and dispensing system which can also be used with a bowl
3 feeder.

4
5 Yet another object of the invention is to provide a counting
6 and dispensing system which is adapted for rapid exchange of
7 cassettes and bowl feeders.

8
9 It is yet an additional object of the invention to provide a
10 counting and dispensing system which functions with high
11 reliability.

12
13 In accord with these objects, which will be discussed in
14 detail below, an object counting and dispensing system is provided
15 which includes a vibration system which substantially circularly
16 vibrates in a horizontal circular plane, a mounting assembly for
17 coupling a cassette to the vibration system, a chute configured to
18 receive discrete objects from either the cassette or a funnel and
19 dispense the objects to a patient bottle, and an object sensing
20 system which senses and counts objects fed into the chute.

21
22 Each cassette includes a base and a stepped side wall which
23 together define a central open reservoir portion and at least one
24 substantially planar covered tray portion surrounding the
25 reservoir portion. A lid is removably coupled over the reservoir

1 portion. The reservoir portion is adapted to store tablets and
2 feed the tablets through a path into the tray portion. The tray
3 portion has a peripheral exit and guides the fed tablets toward
4 the exit when the cassette is vibrated by the vibration system.
5 The tray portion optionally includes a peripheral track which
6 facilitates the guidance of tablets having non-flat surfaces
7 toward the exit. A leaf spring gate closes the exit and is
8 automatically opened by a permanent magnet attached to the tip of
9 a solenoid when the cassette is attached to the mounting assembly,
10 and closed when the cassette is removed therefrom. When the last
11 tablet in a batch has been counted, the magnet is retracted and
12 the leaf spring closes the exit of the cassette. The leaf spring
13 also closes the cassette when the cassette is removed from the
14 mounting assembly and moved away from the magnet. Each cassette
15 includes a lower metal portion at which the cassette is mounted to
16 the mounting assembly. Cassettes are mounted to the mounting
17 assembly in a manner which permits rapid and secure coupling and
18 decoupling. Preferred coupling means include an electromagnetic
19 coupling system.

20
21 Each cassette is able to feed and guide a range of sizes and
22 shapes of tablets toward the exit. As such, only a few standard
23 sizes of cassettes are needed to accommodate a wide range of
24 discrete objects for which the counter is primarily adapted:
25 tablets, capsules, caplets, etc. When used with the cassette,

1 the system functions as a preset counter wherein the counter is
2 preset to count a desired number of tablets, and the counter then
3 feeds and counts the exact number of tablets from the cassette.
4

5 As briefly discussed above, according to another aspect of
6 the invention, the system can be used without the cassette and
7 operate as a pour-through counter in which tablets are poured into
8 the funnel.
9

10 In addition, a universal bowl feeder can be attached to the
11 mounting assembly, preferably in the same manner as the cassettes.
12 The bowl feeder can accommodate prescriptions which are not
13 provided with their own cassette and for which it is desired to
14 preset the number of tablets to be counted.
15

16 Additional objects and advantages of the invention will
17 become apparent to the skilled in the art upon reference to the
18 detailed description taken in conjunction with the provided
19 figures.
20

21 BRIEF DESCRIPTION OF THE DRAWINGS

22

23 Fig. 1 is a perspective view of a system for feeding,
24 counting, and dispensing discrete objects according to the
25 invention, shown with a cassette attached thereto;

Fig. 2 is a plan view of the system for feeding, counting, and dispensing objects according to the invention, shown with a cassette attached thereto;

Fig. 3 is a section view across line 3-3 in Fig. 2;

Fig. 4 is a section view across line 4-4 in Fig. 2;

Fig. 5 is a perspective view of the assembly of a vibration system, a mounting assembly, a chute and a spout, and an object sensing system, and a cassette attached to the mounting assembly, the cassette having a gate in an open position;

Fig. 6 is an exploded perspective view showing the spout removed from the housing of the system according to the invention;

Fig. 7 is a perspective view of a cassette according to the invention with a lid enclosing the reservoir of the cassette;

Fig. 8 is a section view across line 8-8 in Fig. 7;

Fig. 9 is a perspective view of a cassette according to the invention without a lid enclosing the reservoir of the cassette;

Fig. 10 is a plan view of a base portion of the cassette according to the invention;

Fig. 11 is a perspective view of the assembly of a vibration system, a mounting assembly, a chute and a spout, and an object sensing system, and a cassette attached to the mounting assembly, the cassette having a gate in an open position;

Fig. 12 is a bottom perspective view of the mounting system and the vibration system, the mounting system shown with a cassette coupled thereto;

Fig. 13 is a top perspective view of the mounting system and the vibration system;

Fig. 14 is a plan view of the base portion of the cassette provided with capsules and illustrating the movement of capsules thereon;

Fig. 15 is a section view of a multi-tray cassette according to the invention;

Fig. 16 is a plan view of a bottom tray of the multi-tray cassette of Fig. 15;

Fig. 17 is a plan view of a top tray of the multi-tray cassette of Fig. 15;

Fig. 18 is an exploded perspective view of the system for feeding, counting, and dispensing discrete objects according to the invention, shown with a funnel adapted to be provided in alignment with the chute of the system;

Fig. 19 is a plan view of the system for feeding, counting, and dispensing objects according to the invention, shown with a funnel attached in alignment with the chute; and

Fig. 20 is a perspective view of a universal vibratory bowl feeder attached to the mounting and vibratory assemblies according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to Figs. 1 through 5, according to a preferred embodiment of the invention, an object counting, feeding, and dispensing system 10 includes a vibration system 12 which substantially circularly vibrates in a horizontal plane, a mounting assembly 14, described in detail below, which secures a cassette 16 to the vibration system in a manner in which the cassette may be rapidly removed such that another cassette can be

1 rapidly secured to the mounting assembly, a chute 18 oriented to
2 receive discrete objects from a cassette 16 and feed the objects
3 to a bottle or container located at an exit spout 21 beneath the
4 chute, and an object counting system 22 which through windows 23a,
5 23b senses and counts objects passing within the chute 18.
6 Hereinafter, the term 'tablets' is used interchangeably with
7 'objects', unless the context dictates otherwise.

8
9 The vibration system 12, mounting assembly 14, chute 18, and
10 object counting system 22 are provided in a housing 24. The
11 housing 24 is provided with a user display 26, and an input panel
12 28, as well as a microprocessor 30. The display 26 indicates the
13 number of tablets counted, and is coupled via the microprocessor
14 30 to the object counting system 22. The input panel 28 permits
15 the user to input a number of tablets which the system is to feed,
16 count and dispense to a bottle. A power supply 34 is electrically
17 coupled to the vibration system 12, the mounting assembly 14, the
18 object counting system 22, the display 26 and input panel 28, and
19 the microprocessor 30. The object counting system 22 is
20 preferably an optical system which uses an optical sensor array,
21 such as that disclosed in co-owned U.S. Patent No. 5,768,327,
22 which is hereby incorporated by reference herein in its entirety.
23 The optical sensor array of U.S. Patent No. 5,768,327 includes an
24 orthogonal arrangement of two discrete optical sensors which
25 together sense objects in three dimensions. This sensor

1 arrangement is adapted to sense multiple objects simultaneously
2 falling passed the sensors. Alternatively, the counting system
3 may include any other counter for counting discrete objects which
4 is known in the art. As shown in Fig. 6, the spout 21 includes an
5 upper lip 21a at which the spout is preferably removably mounted
6 on two slides 110, 112 which holds the spout beneath the chute,
7 but permits removal. The spout is also preferably provided with a
8 gate 114 which prevents dispensing from the spout until lifted,
9 thereby preventing the tablets from spilling from the spout until
10 the user is prepared with a bottle at the exit spout. The spout
11 21 may be slidably removed from the slides 110, 112 for cleaning.
12 In addition, the spout can be removed for transfer of the contents
13 of the spout to another location (with the gate in the closed
14 position), and then inverted to pour the spout contents from the
15 lip end of the spout.

16
17 Referring to Figs. 1 and 2, the top of the housing 24
18 preferably includes an upper deck 120, a lower deck 122, and a
19 generally vertical wall 124 at the junction thereof. The upper
20 deck 120 includes a circular-portion recess 128 which extends
21 through the wall 124 and which is sized and shaped to receive a
22 preferably substantial portion of a cassette 16. The recess 128
23 is preferably approximately 270° in curvature. The mounting
24 assembly 14 is accessible at the recess 128. The recess 128 also
25 includes a sensor 129 (Figs. 18 and 19) which senses when a

1 cassette is positioned in the recess. The chute 18 has an
2 entrance 130 on the lower deck 122 which is preferably provided
3 with a shield 132 which partially covers the entrance of the
4 chute. The shield 132 has several functions: it functions as a
5 light shield to prevent stray light from interfering with the
6 optical sensory array of the object counting system 22, it
7 functions as a object shield to prevent stray objects from falling
8 into the chute and being counted, and it may function as a
9 placement guide to facilitate the rapid placement of a cassette on
10 the mounting assembly 14. While the shield 132 is preferably a
11 discrete element which may be positioned in the chute, it may
12 alternatively be formed as part of the cassette to provide some or
13 all the same functionality. As such, when the cassette is
14 provided on the mounting assembly, the shield initially would
15 function as a guide to facilitate the placement of a cassette on
16 the mounting assembly, and then shield stray light from the
17 optical sensory array and prevent stray objects from falling into
18 the chute.

19
20 Turning now to Figs. 7 through 10, each cassette 16 includes
21 a relatively thin preferably plastic base 40 and a preferably
22 plastic top element comprised of a wall 42 and an annular shelf 43
23 fixedly coupled to the base such that the base and top element
24 together define a central reservoir portion 44 and a peripheral
25 covered tray portion 46. The base 40 preferably includes a

1 peripheral wall 48, and a reservoir wall 50 concentric with the
2 peripheral wall and having an opening 52. An entry guide 56 is
3 obliquely angled relative to the reservoir wall 50 at the opening
4 52 and defines a narrow 53 between the end of the entry guide and
5 the peripheral wall which serves as an entry to track area 54.
6 The base 40 also includes an exit hole 58 adjacent the peripheral
7 wall 48 substantially 270° counterclockwise relative to the entry
8 guide 56, and an exit guide 60 located relative to the peripheral
9 wall 48 such that tablets traveling between the peripheral wall 48
10 and the exit guide 60 are directed in a single file to the exit
11 hole 58. The base 40 preferably includes a return guide 62 which
12 facilitates movement of tablets which have not entered the exit
13 guide 60 in the counterclockwise direction back toward the entry
14 guide.

15
16 In the preferred embodiment, the opening 52 is defined
17 between the entry guide 56 and a free end 64 of the return guide
18 62. Optionally, a shallow concavely curved or sloped channel 66
19 having a width for guiding a single tablet or capsule is formed in
20 the base 40 adjacent a portion of the peripheral wall 48 from the
21 location of the entry guide 60 counterclockwise to the exit hole
22 58. The width of channel is preferably between 0.5 - 1.5 times
23 the width of the range of tablets or capsules for which the
24 cassette is designed. The base 40 preferably also includes a
25 central circular hole 68, and a metal plate 70 on the base over

1 the hole 68 (Figs. 8 and 9). The plate 70 includes a hole 71, and
2 a post 72 is coupled in the hole 71 and extends vertically upwards
3 therefrom. The upper end 74 of the post is threaded. A lid 76
4 including a central hole 78 is provided on the top element 42 such
5 that the upper end 74 of the post extends through the hole 78. A
6 knob 80 is threaded onto the post in order to secure the lid 76 on
7 the top element 42 and to enclose the reservoir 44 (Figs. 7 and
8 8).

9
10 Preferably the height of each of the peripheral wall 48, the
11 reservoir wall 50, and the guides 56, 60 and 62 is the same,
12 height H (Fig. 8). The shelf 43 rests on the walls 48 and 50 and
13 guides 56, 60 and 62 to substantially enclose the tray portion 46
14 to provide the tray portion with a height H. The height H is
15 preferably substantially 1.2 to 1.8 times the height of a tablet
16 (across the diameter of cylindrical capsules and caplets, or
17 transverse to the flattest surface of a tablet) which is to be
18 stored in and fed from the cassette. In addition, the opening 52
19 is preferably approximately three to eight tablets in size (across
20 the diameter of cylindrical capsules and caplets or the flattest
21 surface of a tablet). Furthermore, the narrows 53 is preferably
22 approximately two to four tablets in size (across the diameter of
23 cylindrical capsules and caplets or the flattest surface of a
24 tablet). As such, a single cassette is adapted to feed and guide
25 a range of sizes and shapes of discrete objects toward the exit.

1 Only a few standard cassettes sizes are thereby needed to
2 accommodate all discrete objects for which the counter is
3 primarily adapted: tablets, capsules, caplets, etc. In addition,
4 the manufacture of the cassettes is relatively inexpensive, as the
5 primary material of manufacture is plastic, and the cassette for
6 an individual prescription does not need to be custom
7 manufactured.

8
9 Referring back to Fig. 5, the cassette 16 is provided with a
10 metal leaf spring 81 having an upturned gate portion 82 extending
11 into and blocking the exit hole 58 of the cassette. A means,
12 e.g., a solenoid 83, is provided in the housing for automatically
13 opening the gate and permitting the tablets to exit the exit hole
14 58 of the cassette 16. The solenoid 83 is mounted on a mounting
15 bracket 99 and has a shaft 83a extending thereabove. The solenoid
16 shaft 83a preferably does not contact the gate to open the gate.
17 Rather, a magnet 83b is provided at the end of the shaft 83a.
18 When the solenoid 83 is actuated, the magnet 83b is moved closer
19 to the leaf spring 81 causing the leaf spring to deflect toward
20 the magnet 83b and pull the gate portion 82 from the exit hole 58
21 to permit the release of tablets in the cassette (Fig. 11).
22 Deactivation of the solenoid 83 moves the magnet 83b further from
23 the leaf spring 81 such that the bias of the leaf spring overcomes
24 the force of the magnet 83b, and the exit hole 58 is again closed
25 by the gate portion 82 (Fig. 5). Other magnetic, mechanical or

1 electromechanical elements or assemblies may alternatively be used
2 to close and open the exit hole of the cassette.

3
4 Referring to Figs. 1 through 3 and 5, the cassette 16
5 preferably also includes two alignment posts 84, 85. The posts
6 84, 85 are preferably equally spaced apart about the exit hole 58.
7 The posts 84, 85 are preferably nondiametrically located, and most
8 preferably separated by approximately 120°. The posts are spaced
9 to align the cassette with the wall 124 on the housing (but
10 preferably not contact the wall) when the cassette 16 is placed on
11 the upper deck 120 (Figs. 1 and 2). This ensures alignment of the
12 exit hole 58 over the chute entrance 130.

13
14 Cassettes 16 are mounted to the mounting assembly 14 in a
15 manner which permits rapid and secure coupling and decoupling.
16 Preferred coupling means include electromagnetic coupling and
17 power-driven clamping systems. Referring to Figs. 12 and 13, with
18 respect to an electromagnetic coupling, the mounting assembly 14
19 includes a base 86 provided with a preferably cylindrical
20 electromagnet 88 sized to fit snugly at least partially within the
21 hole 68 in the bottom of the cassette and provided adjacent the
22 metal plate 70. The cassette 16 is provided over the
23 electromagnet 88, and the electromagnet is activated to cause a
24 secure coupling of the cassette thereto. Conversely, deactivation
25 of the electromagnet permits rapid decoupling of the cassette from

1 the mounting assembly. The base 86 preferably includes a
2 plurality of resilient ball plungers 90 adapted to force the
3 bottom of the cassette 16 from its snug fitting over the
4 electromagnet 88 when the electromagnetic is deactivated. The
5 base 86 is also coupled to two brackets 92 on opposite sides of
6 the base adapted to couple the base to the vibration system 12.

7
8 Still referring to Figs. 12 and 13, the vibration system 12
9 includes two shaker elements (electromechanical vibrators known in
10 the art) 94 which are coupled to opposite side walls 96 of a rigid
11 U-shaped block 98. In turn, the brackets 92 of the mounting
12 assembly 14 are coupled between the shaker elements 94. The
13 shaker elements 94 are adapted to provide a horizontal circular
14 vibratory motion in the feed direction (Fig. 10) to the mounting
15 assembly and consequently to a cassette rigidly mounted on the
16 mounting assembly. The inertial block 98 is coupled by rubber
17 shock mounts 100 to a support 102 within the housing. The shock
18 mounts 100 substantially prevent vibratory energy from being
19 transferred to the housing 24.

20
21 In use, the reservoirs of a plurality of cassettes in a
22 pharmacy setting are each provided with the tablets of a different
23 prescription medicine. If it is then desired to count a fixed or
24 predetermined number (e.g., one hundred) of capsules 104 of a
25 particular prescription into a bottle, the cassette 16 containing

1 the particular prescription is provided on the mounting assembly
2 14 of the system. This is particularly done by providing the
3 cassette in the recess 128 in an orientation in which the
4 alignment posts align the cassette with the edges of the wall 124.
5 The desired number of capsules to be counted is then entered via
6 the keypad 28, a patient prescription bottle is placed adjacent
7 exit spout 21, and a start button on the keypad is activated.
8 Operation of the start button (1) provides electricity to the
9 electromagnet 88 to temporarily secure the cassette 16 thereon,
10 (2) activates the solenoid 83 to open the gate portion 82 of the
11 leaf spring 81 on the cassette, and (3) operates the vibration
12 system 12 to initiate vibration of the cassette. Referring to
13 Figs. 3, 8, 10 and 14, when the cassette 16 is vibrated by the
14 vibration system 12, capsules 104 in the reservoir 44 of the
15 cassette are moved in the counterclockwise feed direction through
16 the opening 52 and the narrow 53 (it being appreciated that for
17 purposes of clarity far fewer capsules than typically present are
18 shown). The height H of the opening 52 and size of the narrow 53
19 limits too many capsule from entering the track area 54 at one
20 time as the opening height basically guarantees that the capsule
21 will not exit the reservoir in a stacked configuration while the
22 narrow limits the number of capsules simultaneously entering the
23 track area. Referring to Fig. 14, the vibration urges capsules
24 which have passed through the narrow 53 and into the track area 54
25 to move toward the peripheral wall 48 and into the channel 66.

1 Generally, the capsules are provided in a quantity to
2 substantially fill the reservoir 44 and crowd the track area 54.
3 The channel 66 is sized to receive the capsules 104 in a
4 lengthwise orientation. The capsules 104 continue in the channel
5 66 in a counterclockwise movement through the exit guide 60 and
6 are directed single file toward the exit 58. The capsules fall
7 through the exit 58, enter the chute 18, are each counted by the
8 object counting system 22, and are dispensed at the spout 21 into
9 a bottle (Figs. 1 and 3). Capsules 104 which do not exit the
10 cassette 16 during a first pass around the track area 54 are
11 guided back toward the narrow by the return guide 62. The
12 capsules 104 continue traveling around the track area 54 and
13 through the exit 58 until the selected number of capsules is
14 counted, as indicated by the display 26. Once the system has
15 counted the required number of capsules, the vibration stops, the
16 solenoid releases the gate, and the cassette is released from the
17 mounting assembly. With this system, objects can be fed and
18 counted relatively rapidly, typically from five to twenty per
19 second.

20
21 According to a preferred aspect of the invention, when the
22 system has counted to near the required number, the vibration
23 system vibrates at a lower amplitude to slow down the rate of
24 counting. This feature substantially prevents overcounts which
25 may occur due to having counted the required number of capsules

1 even though uncounted capsules still exist in the space between
2 the exit hole 58 and the counting system 22. A slow down system
3 is described in detail in co-owned U.S. Patent No. 5,473,703,
4 which is hereby incorporated by reference herein in its entirety.

5
6 A cassette can easily and rapidly be removed from the system
7 by removing the power to the electromagnet 88. The ball plungers
8 90 then push the cassette from over the electromagnet to
9 facilitate manual removal of the cassette from the mounting
10 assembly. A second cassette may then be placed over the
11 electromagnet and power can then be resupplied to the
12 electromagnet to provide a very secure coupling with the second
13 cassette.

14
15 It is noted that in cassette 16, all tablets must travel in
16 single file through exit hole 58. As such, one limitation of the
17 cassette system is the speed at which tablets or other single dose
18 medications can be fed and exited into the chute for counting. In
19 view thereof, a second embodiment of a cassette adapted to feed
20 tablets more rapidly and yield greater system throughput is
21 provided. Turning now to Figs. 15, 16 and 17, the second
22 embodiment of the cassette 216 generally includes a reservoir 244
23 which feeds tablets and other single dose medication to two
24 discrete trays (levels) 254, 255. Each tray is provided with an
25 exit hole 258, 259 which feeds the tablets into the chute 18 of

1 the system 10. More particularly, the cassette 216 includes a
2 base 240 having an upper surface defining the first tray 254, an
3 intermediate shelf 241 having an upper surface defining the second
4 tray 255, an annular cover over the shelf 243, and a cylindrical
5 element 242 over the cover and which defines the reservoir portion
6 244. The base 240, as shown in Fig. 16, is substantially similar
7 to base 40 with the following exception: a second hole 281,
8 preferably walled-off from exit hole 258 and the remainder of the
9 first tray 254, is provided preferably adjacent exit hole 258.
10 The second hole 281 is provided along the periphery of the tray
11 and located counterclockwise from the exit hole 258. Referring to
12 Fig. 17, the shelf 241 is also substantially similar to base 40
13 with the following exceptions. First, exit hole 259 is aligned
14 over the second hole 281 on the first tray 254. Second, the shelf
15 includes a relatively large central opening 283 adapted to permit
16 tablets in the reservoir 244 to pass therethrough and onto the
17 first tray 254.

18
19 When tablets are provided into the reservoir, they naturally
20 stack substantially in the formation shown in broken lines in Fig.
21 15. As the cassette is vibrated, tablets move from the stack onto
22 the tray and shelf, and peripherally to the tracks 254, 255. From
23 the tracks, the tablets are fed toward the exit holes 258, 259.
24 Tablets exiting exit hole 258 fall directly into the entrance 130
25 of the chute 18. Tablets exiting exit hole 259 fall through hole

1 281 in the first tray and then into the chute 18. In order to
 2 close the exit holes, two leaf spring gates 291, 293 are used.
 3 Opening of the spring gates may be actuated by two solenoids
 4 provided in the housing 24, each being to adapted to separately
 5 open one of the gates. Alternatively, a single solenoid
 6 configured to open both gates, e.g., having two arm portions
 7 coupled thereto, may be used to operate both gates. Where two
 8 solenoids are used, it may be preferable to have one of the
 9 solenoids operate to release and close one of the gates when the
 10 number of counted tablets approaches the number desired, leaving
 11 only one of the gates open. This prevents two tablets from
 12 substantially simultaneously falling into the chute (one from each
 13 exit hole) when only one additional tablet is needed for a full
 14 count.

15
 16 As stated above, the dual sensor array of previously
 17 incorporated U.S. Patent No. 5,768,327 is adapted to sense
 18 multiple objects simultaneously falling passed the sensors. As
 19 such, it is ideally suited to sense tablets exiting from the two-
 20 level cassette.

21
 22 The above cassette embodiments permit rapid dispensing of
 23 medications stored in the cassettes. However, there may be
 24 medications in a pharmacy which are used with an infrequency such
 25 that cassette storage is not warranted. Therefore, turning now to

1 Figs. 18 and 19, according to another aspect of the invention, the
2 system 10 may be used as a pour-through system. When a cassette
3 16, 216 is not located on the mounting assembly and the shield 132
4 is removed from over the chute entrance 130, a funnel 134 into
5 which tablets may be poured is provided in the chute entrance. In
6 this pass-through configuration, no preset number is entered prior
7 to pouring tablets into the funnel. Rather, sensor 129 indicates
8 that a cassette is not being used, and the system 10 is
9 automatically adapted to count tablets passing through the funnel.
10 The number of tablets counted is displayed on the display 26.

11
12 Referring now to Fig. 20, according to another aspect of the
13 invention, a universal bowl feeder 316 can be attached to and
14 detached from the mounting assembly 14, preferably in the same
15 manner as the cassettes. As such, the bowl feeder 316 is made
16 from metal or made from plastic and provided with a metal insert
17 or bottom plate, as described with respect to the cassettes. This
18 enables the bottom 318 of the feeder 316 to be mounted to the
19 mounting assembly 14. The feeder 316 has a reservoir 320 which
20 holds tablets, and a ramp 322 designed to feed practically any
21 size or shape tablet or other single dose medication. Bowl
22 feeders with this interior design are available from Kirby Lester
23 Inc. of Stamford, CT. Referring to Figs. 4, 15 and 17, the bowl
24 feeder 316 is positionable within the recess 128 such that the
25 sensor 129 causes the system to enter preset counting mode. A

1 desired number of tablets is entered via the keypad 128, and a
2 start button on the keypad is then actuated causing the
3 electromagnet of the mounting assembly 14 to secure the feeder 316
4 thereto, and the vibration system 16 to vibrate the feeder to feed
5 tablets from the reservoir 320, up a the ramp 322, and to an exit
6 324, where the tablets fall into the chute entrance 130 and are
7 then counted by the object counting system 22. The feeder
8 accommodates prescriptions which are not provided their own
9 dedicated cassette, but for which a pharmacist does not wish to
10 manually feed tablets until a desired number of tablets is
11 counted.

12
13 There have been described and illustrated herein embodiments
14 of a cassette system for feeding, counting, and dispensing
15 tablets, capsules, caplets, and the like. While particular
16 embodiments of the invention have been described, it is not
17 intended that the invention be limited thereto, as it is intended
18 that the invention be as broad in scope as the art will allow and
19 that the specification be read likewise. Thus, while the system
20 is described as being suitable for manual cassette coupling and
21 removal in a pharmacy setting, it will be appreciated that the
22 system may be adapted for a robotic system in a pharmacy setting
23 or otherwise. In addition, while an electromagnetic mounting
24 assembly is preferred, it will be appreciated that other rapid and
25 easy to use coupling systems may also be used. For example, a

1 preferably power-driven mechanical coupling which threadably
2 secures the cassette to the mounting assembly can be used.
3 Further, while cassettes with one and two track layers have been
4 described, it will likewise be appreciated that cassettes with
5 three or more track layers can similarly be used to even more
6 rapidly count tablets. Also, while the feed direction is shown
7 and described as being counterclockwise, it will be appreciated
8 that the shakers can be configured to shake the cassette with
9 clockwise motion, and the guides, narrow, and, in one embodiment,
10 two exit holes can be configured to guide tablets in the clockwise
11 direction toward the exits. Further, while particular opening
12 height and narrow dimensions relative to the tablet size were
13 disclosed as being preferred, it will be appreciated that other
14 dimensions could be utilized. Also, while the system is stated to
15 secure the cassette and to the mounting assembly upon activation
16 of a start button, it will be appreciated that locking may occur
17 based upon the sensor recognizing a cassette or bowl feeder being
18 placed on the mounting assembly. In addition, the release of the
19 gate by the solenoid and the release of the cassette or bowl
20 feeder from the mounting assembly may be triggered by means other
21 than described. Furthermore, the funnel may be permanently
22 coupled to the housing in a manner which permits placement and
23 removal of a cassette in conjunction with the funnel. Also, the
24 system may include a two-layer cassette and have two separate
25 feeds each having a one-dimensional optical system for sensing

1 tablets passing through the feeds, the feeds then going to a
2 common chute or exit spout. It will therefore be appreciated by
3 those skilled in the art that yet other modifications could be
4 made to the provided invention without deviating from its spirit
5 and scope as claimed.